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January 13, 1840.

SIR WM. R. HAMILTON, LL. D., President, in the Chair.

Sir Philip Crampton, Bart., William J. Lloyd, Esq., and John Mollan, M. D. were elected members of the Academy.

Professor Mac Cullagh made a communication respecting the optical Laws of Rock-crystal (Quartz).

In a paper read to the Academy in February 1836, and published in the Transactions, (vol. xvii. p. 461,) he had shown how the peculiar properties of that crystal might be explained, by adding, to the usual equations of vibratory motion, certain terms depending on differential coefficients of the third order, and containing only one new constant c. This hypothesis, which was very simple in itself, not only involved as consequences all the laws that were previously known, but led to the discovery of a new one—the law, namely, by which the ellipticity of the vibrations depends on the direction of the ray within the crystal. He was not able, however, to account for his hypothesis, nor has it since been accounted for by any one.

But the theory developed in the paper which he read at the last meeting of the Academy, now enables him to assign, with a high degree of probability, the origin of the additional terms above-mentioned, and, if not to account for them mechanically, at least to advance a step higher in the inquiry. In that theory it was supposed, (and the supposition holds good in all known crystals, except quartz,) that the molecules of the ether vibrate in right lines, the displacements remaining always parallel to each other as the wave is propagated; and it was shown that the function v, by which the motion is determined, then depends only on the *relative displacements* of the molecules. But when this is not the case,—when, as in quartz, each molecule is supposed to vibrate in a curve—then it is natural to conceive that the function v may depend, not only on the relative displacements, but also on the *relative areas* which each molecule describes about every other more or less advanced in its vibration. This idea, analytically expressed, introduces a new term v into the value of the function 2v; and, if the plane of the wave be taken for the plane of xy, it is easy to show that

$$v = c\left(\frac{d\eta}{dz}\frac{d^2\xi}{dz^2} - \frac{d\xi}{dz}\frac{d^2\eta}{dz^2}\right).$$

Now if we integrate by parts the expression

$$\iiint dxdydz\delta v,$$

so as to get rid of the variations of differential coefficients, the reduced form of the triple integral will be

$$2c\iiint dxdydz\left(\frac{d^3\eta}{dz^3}\delta\xi - \frac{d^3\xi}{dz^3}\delta\eta\right);$$

from which it appears that the quantities

$$c\frac{d^3\eta}{dz^3}, \quad -c\frac{d^3\xi}{dz^3},$$

are to be added to the usual expressions for the force in the directions of x and y respectively. These are the very terms in the addition of which the hypothesis before alluded to consists.

The Secretary read a paper by James Orchard Halliwell, Esq. F. R. S., &c., entitled "an Inquiry into the Period of the first Use of the Zero by those Writers who adopted the Notation of the Boetian numerical Contractions."

The author referred, at the commencement of this communication, to the opinion which he had formerly expressed on the nature of the change from the use of the abacus, to that of local position, and the cipher. This opinion is contained in the following extract: "It would be impossible, with the few materials yet brought to light, to conjecture with any great probability, how far these Boetian contractions may have influenced the introduction, or cooperated with the Arabic system, to the formation of our present numerical notation. It appears to me highly probable that the two systems became united; because the middle age forms of the figure *five* coincide with the Boetian mark for the same numeral, and those of two others are very similar. The idea of local position, again, may have had an independent European origin; the inconveniences of the abacus on paper would have suggested it by destroying the distinguishing boundaries, and inventing an arbitrary hieroglyphic for the representation of an empty square."

The author then proceeded to adduce evidence from some documents recently discovered in support of these views. He showed from the Mentz MS. in the Arundel collection, in what manner the mode of operation with the abacus had been improved, so as to lead naturally to the present system. He then brought forward some passages from MSS. illustrative of the first employment of the zero; and concluded by adducing an instance from a MS. of the translation of Euclid by Athelard, of the fourteenth century, belonging to the Arundel collection, in which the number 15 is written in these contractions, and without a division.

DONATIONS.

Catalogue des Principales Apparitions des etoiles filantes. Par A. Quetelet.

Sur l'etat du Magnétisme Terrestre a Bruxelles, pendant les douze années de 1827 *a* 1839. Par A. Quetelet.

Sur la Longitude de l'Observatoire Royal de Bruxelles. Par A. Quetelet.

Presented by the Author.

Asiatic Researches. Vol. XX., Part 2. Presented by the Asiatic Society of Bengal.

The American Almanac for 1840. Presented by the American Philosophical Society.

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Par MM. les Secretaires Perpetuels. Nos. 20-26. Deuxiéme Semestre. 1839. Presented by the Academy.

Transits and Calculations of apparent right Ascensions. 1834.

Zenith Distances observed with the Mural Circle, and Calculations of Geocentric South Polar Distances. 1836 and 1837.

Declinations of the principal fixed Stars, deduced from Observations made at the Observatory, Cape of Good Hope. By Thomas Henderson, Esq.

Observations of Halley's Comet, made at the Royal Observatory, Cape of Good Hope.

Bessel's Refraction Tables.

Presented by the Lords Commissioners of the Admiralty.

By-Laws of the Institute of Architects of Ireland. Presented by the Society.

The Mahawanso, with Translation in English. By the Hon. George Turnour, Esq. Presented by F. B. Norris, Esq., Surveyor General of Ceylon, per I. S. Cooper, Esq.

Medical Report of the Fever Hospital, for 1837-1838. Presented by G. A. Kennedy, M.D.

The Dublin Penny Journal. Nos. 67, 104, Vol. II.; Nos. 191, 198, Vol. IV. Presented by P. Dixon Hardy, Esq.